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EXAMINER	
TUCKER, WESLEY J	

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2623	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/831,992	Applicant(s) NICOLAS ET AL.
	Examiner Wes Tucker	Art Unit 2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 December 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4,5 and 9-11* is/are rejected.

7)☒ Claim(s) *3 and 6-8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments and Amendments

1. Applicant's response to the last Office Action, filed December 8th, 2004 has been entered and made of record.

2. Applicant has amended claims 1-11. Claims 1-11 are pending.

3. Applicant's arguments, filed December 8th, 2004, with respect to the rejection(s) of claim(s) 1-11 have been considered and are not persuasive for at least the following reasons:

4. Applicant argues that the reference of U.S. Patent 6,668,082 does not disclose all the limitations claimed in claim 1 and disputes the rejection of claims 1, 9 and 11 under 35 USC 102(e). Applicant points out that the present invention selects pixels according to a 3D resolution and that Davidson does not disclose or suggest "calculation for an image, of a resolution map [nor] selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel" as claimed in claim 1 of the present invention. However Examiner submits that broadly interpreted, the reference of Davidson still reads on the limitations of claim 1. The interpretation of Davidson in regard to claim 1 is detailed on pages 6-8 of the office action filed August 12th, 2004. Davidson discloses an apparatus wherein a 3D image, which inherently has a measure of depth, is determined or calculated (Fig. 3, step 10) in accordance with images taken from various

viewpoints using object features in the images and matching those features (column 2, lines 28-46). The reference of Davidson is interpreted to read on the limitations of claim 1 as claimed. Therefore the rejection is maintained and accordingly made final.

5. Applicant's arguments in regard to the 35 USC 103 combination obviousness rejections seem to be drawn to the argument that the reference of Davidson does not satisfy the features of claim 1 and do not specifically address the elements of the dependent claims. Therefore the arguments are accordingly responded to in the discussion of claim 1.

6. Applicant's arguments in view of the 35 USC 112 rejection of claims 2 and 11 have been considered and are found persuasive in view of the amendment of to claim 11 and the discussion of claim 2. The rejection under 35 USC 112 second paragraph is withdrawn.

7. The objections to the drawings, the specification and claims 1-11 are withdrawn in view of applicant's submitted amendments.

Drawings

8. The objections to the drawings are withdrawn in view of Applicant's amendments.

Specification

9. The objections to the specification are withdrawn in view of Applicant's amendments.

Claims

Objections

1. The objection to claims 1-11 have been withdrawn in view of Applicant's amendments.

Rejections Under 35 U.S.C. § 102(e)

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 9 and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by Davidson et al.

4. *The following is in regard to Claim 1.* Davidson et al. disclose a method for constructing a 3D scene model by analyzing image sequences, each image corresponding to a viewpoint defined by its position and its orientation (see Davidson et al. Fig. 2 and Abstract), wherein it comprises the following steps:

(1.a.) Calculation, for an image, of a depth map corresponding to the depth, in 3D space, of the pixels of the image. See Davidson et al. Fig. 3, step S10 and note depth is inherent to 3D data.

(1.b.) Calculation, for an image, of a resolution map (i.e. set of calculated inter-point distances (SHIFT) – Davidson et al. Figs. 43-45b) corresponding to the 3D resolution of the pixels of the image, from the depth map (i.e. 3D data - Davidson et al. Fig. 3, step S10). See Davidson et al. column 43, lines 3-4, column 44, lines 1-40. 3D resolution is taken to be the inter-point distance, which is a measure of pixel dispersion. This definition is essentially the same as the Applicant's definition of 3D resolution.

(1.c.) Matching of a pixel of a current image with a pixel of another image of the sequence (e.g. Davidson et al. Fig. 3, step S8, column 7, lines 39-45 and column 10, lines 53-61).

1. The matching is achieved by projecting the pixel of the current

image onto the other image (e.g. Davidson et al. column 18, lines 34-59 and/or column 33, lines 38-53 and/or column 41, lines 40-55 and column 42, lines 31-54).

2. The matching pixels relate to one and the same point of the 3D scene (e.g. Davidson et al. Figs. 29a).

(1.d.) Selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel. Notice steps 558-560 of Davidson et al. Fig. 44a. Here, discarding points of excessive inter-point distance (i.e. low 3D resolution), results in the selection of a set of points, and correspondingly a set of pixels, used in the subsequent construction.

(1.e) Construction of the 3D model from the selected pixels (Davidson et al. Fig. 3, steps S12-S14).

It has thus been shown that the 3D model construction method of Davidson et al. sufficiently conforms to the method proposed by the Applicant in claim 1. Therefore, the teachings of Davidson et al. anticipate the method of claim 1.

5. *The following is in regard to Claim 9.* As shown above, Davidson et al. disclose a 3D model construction method that sufficiently conforms to the method of claim 1. In the method of Davidson et al., the pixel of the other image is the pixel closest to the projection point on this other image. See, for example, Davidson et al. Fig. 35. The 3D model construction method of Davidson et al. thus sufficiently conforms to the method

proposed by the Applicant in claim 9. Therefore, the teachings of Davidson et al. anticipate the method of claim 9.

6. *The following is in regard to Claim 11.* As shown above, Davidson et al. disclose a 3D model construction method that sufficiently conforms to the method of claim 1. Davidson et al. suggest the usage of the derived model in virtual reality applications (e.g. ones that employ VRML – Davidson et al. column 6, lines 3-5). The following aspects of claim 11 are inherent to virtual reality applications:

(11.a□.) Creating images as a function of the movement of the viewpoint.

(11.b□) These images are of different viewpoints of a 3D model.

Therefore, a virtual-reality application utilizing a model(s) obtained according to the method of Davidson et al., would constitute a method of navigation in a 3D scene consisting of:

(11.a.) Creating images as a function of the movement of the viewpoint.

(11.b) These images are of different viewpoints of the 3D model(s) derived according to Claim 1.

This is clearly in accordance with the method proposed in claim 11.

Rejections Under 35 U.S.C. § 103(a)

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made

to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davidson et al., in view of Azarbayejani et al. (U.S. Patent 5,511,153).

9. *The following is in regard to Claim 2.* As shown above, Davidson et al. disclose a 3D model construction method that sufficiently conforms to the method of claim 1. Clearly, the points selected according to the method of Davidson et al. constitute one or more regions. Furthermore, as stated above, the method of Davidson et al. selects pixels depending on the resolution (see the discussion relating to step (1.d) above). However, Davidson et al. do not expressly show or suggest:

(2.a.) Calculation and allocation of weights to the pixels of the image depending on:

1. whether or not they belong to the regions
2. on the geometrical characteristics of the regions to which they belong in the image.

(2.b.) A selection of the pixels performed depending on the weight values assigned to the pixels.

10. Azarbayejani et al.[1], on the other hand, disclose a method for constructing a 3D scene model by analyzing image sequences, wherein:

(2.a□.) Weights (e.g. $1/(1+Z_C\beta)$ in Azarbayejani et al. equation (2) or □ in Azarbayejani et al. equation (3)) are calculated and allocated to the pixels of the image. See Azarbayejani et al. equations (2) and (3), for example. The weights □̃, □□ represent the geometric characteristics or structure of an image feature (i.e. region) to which the pixels belong (Azarbayejani et al. column 6, lines 5-13) and are indicative of whether or not they belong to the feature (Azarbayejani et al. column 5, lines 54-60).

(2.b□.) A selection of the pixels performed depending on the weight values assigned to the pixels (Azarbayejani et al. column 10, lines 52-61).

11. The teachings of Davidson et al. and Azarbayejani et al. are combinable because they are analogous art. Specifically, the teachings of both are directed to 3D model generation from image sequences. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to perform feature tracking (or matching, using Davidson et al.'s nomenclature) in the method of Davidson et al. according to steps (2.a□.)-(2.b□.) of Azarbayejani et al. One would have been motivated to do so because of the accuracy of Azarbayejani et al.'s method.

[1] Note that the various equations of Azarbayejani et al. will be referred to as (1), (2), (3) and so on, beginning with the equation listed in Azarbayejani et al. column 2, line 40.

Combining the teachings of Davidson et al. and Azarbayejani et al. yields a method, in accordance with claim 1, such that:

(2.a.) Calculation and allocation of weights to the pixels of the image depending on:

1. whether or not they belong to the regions
2. on the geometrical characteristics of the regions to which they belong in the image.

(2.b.) A selection of the pixels performed depending on the resolution and weight values assigned to the pixels.

Therefore, such a method would conform to the method proposed in claim 2.

12. Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davidson et al., in view of McAllister et al. ("Real-Time Rendering Techniques of Real World Environments").

13. *The following is in regard to Claim 4.* As shown above, Davidson et al. disclose a 3D model construction method that sufficiently conforms to the method of claim 1. Davidson et al., however, do not expressly show or suggest a partitioning of the images of the sequence characterized by:

(4.a.) Identifying, for a current image, the images whose corresponding viewpoints have an observation field possessing an intersection with the observation field relating to the current image.

(4.b.) Forming a list of images associated therewith.

(4.c.) The list contains images of the sequence that will be used in the matching of the pixels of the current image.

14. McAllister et al. disclose an image-based modeling method that generates a 3D model of an object from a multitude of 2D images (McAllister et al. Abstract). The method entails a partitioning of the images (i.e. into *tiles*) of the sequence (McAllister et al. Section 4.5, paragraph 1) that includes the following:

(4.b.) Forming a list of images associated therewith (McAllister et al. Section 4.6, paragraph 2).

(4.c.) The list contains images of the sequence that will be used in the matching of the pixels of the current image (McAllister et al. Section 4.6, paragraph 2, in particular, lines 4-7).

Note that:

(4.a.) Identifying, for a current image, the images whose corresponding viewpoints have an observation field (i.e. *view frustum* – McAllister et al. Section 4.5 paragraph 1, line 4) possessing an intersection with the observation field relating to the current image.

is inherent to the view-frustum culling of McAllister's et al.'s method. Those view-frustums that are culled correspond to images that sample surfaces which are disjoint from the surfaces imaged by the retained view-frustums. One can conclude from this that the retained and culled view-frustums are divergent. Thus, the view-frustum culling

represents an implicit identification of intersecting view-frustums (i.e. retained view-frustums). That is, the retained view-frustums are those that intersect.

15. The teachings of McAllister et al. and Davidson et al. are combinable because they are analogous art. Specifically, the teachings of both are directed toward the construction of 3D models of scenes from a collection of 2D images. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to integrate the partitioning scheme of McAllister et al. into the method of Davidson et al. The motivation to do so would have been to and eliminate redundant views and imagery from the data set (McAllister et al. Section 4.5, paragraph 1, sentence 3), thereby, improving rendering efficiency (McAllister et al. Section 4.6, last sentence) and storage overhead. Combining the teachings of McAllister et al. and Davidson et al., in this manner, yields a 3D modeling method that conforms substantially to that of claim 4.

16. *The following is in regard to Claim 5.* As just shown, the teachings of McAllister et al. and Davidson et al. can be combined to yield a method that adequately satisfies the limitations of claim 4. Furthermore, the partitioning of the images of the sequence, according to the teachings of McAllister, is performed by removing, from the list associated with an image, the images which possess too few pixels corresponding to those of the current image (McAllister et al. Section 4.6, paragraph 2). Therefore, combining the teachings of McAllister et al. and Davidson et al., in the manner discussed above, yields a 3D modeling method that conforms substantially to that of claim 5.

17. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davidson et al., in view of La Roux et al. ("An Overview of Moving Object Segmentation in Video Images", IEEE, 1991).

18. *The following is in regard to Claim 10.* As shown above, Davidson et al. disclose a 3D model construction method that sufficiently conforms to the method of claim 1. As mentioned above, Davidson et al. attempt to find pixels in the sequence of images that correspond to the same (or approximately the same) 3D point of the imaged scene or object. The following problems associated with deriving stereo correspondences between images of moving objects are well known. Besides potentially inducing undesirable motion blur in the captured images, the movement of an object makes the derivation of correspondences between images of an image sequence extremely difficult or impossible. Though it would be apparent to one of ordinary skill in the art, the method of Davidson et al. does not provide a means to remedy this potential problem.

19. Le Roux, et al. describe several methods to differentiate and extract regions corresponding to moving objects in video images (Le Roux et al. Introduction).

20. The teachings of Le Roux et al. and Davidson et al. are combinable because they are analogous art. In particular, the teachings of both Le Roux et al. and Davidson et al. are directed toward the processing of a sequence of images. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to use moving object segmentation, according to any of the various

techniques discussed by Le Roux et al., to extract regions corresponding to moving objects from the collection of images used by the method of Davidson et al. to generate a 3D model. The motivation for doing so would have been to eliminate regions corresponding to moving objects from the collection of images. By eliminating these regions, correspondences, and hence a 3D model, can be derived for regions of these images that do not move. Combining the teachings of Le Roux et al. and Davidson et al., in this manner, yields a 3D modeling method that conforms substantially to that of claim 10.

Allowable Subject Matter

Objections, Allowable Subject Matter

21. Claims 6-8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

22. The following is a statement of reasons for the indication of allowable subject matter.

23. *The following is in regard to Claims 6-8.* In and of themselves, the substantive limitations set forth in claims 6-8 introduce nothing over similar prior art methods.

However, by virtue of their dependence on allowable claim 3 (see below), these claims, in turn, propose allowable subject matter.

Allowable Subject Matter

24. Claim 3 is allowed.

25. The following is a statement of reasons for the indication of allowable subject matter.

26. *The following is in regard to Claim 3.* As mentioned above with respect to claims 1-2 , the method obtained by combining the teachings of Davidson et al. and Azarbayejani et al., involves assigning both a weight and resolution to pixels of the current image. Though one could arbitrarily designate these values as collectively constituting a *relevance value*, this does not follow directly or impliedly from the teachings of Davidson et al. or Azarbayejani et al. or, for that matter, any encountered prior art methods. Despite this, it would be apparent, if one were to devise such a reference value, that in order for it to be meaningful – or, more specifically, for it to denote the relevance of pixels – within the context of the method obtained by combining the teachings of Davidson et al. and Azarbayejani et al. – the relevance value should be directly proportional to the resolution. This follows from the teachings of Davidson et al. (Davidson et al. Fig. 44a, steps S558-S560). Taking this into account, selected pixels, which according to Davidson et al. have highest 3D resolution (pixels with SHIFT

□10% of object size), would, in turn, have the highest relevance value among all image pixels. Providing an indication (e.g. a table) indicating which pixels are selected would be inherent to the process of selection. Such a collection can be considered a *mask.* Though these latter aspects of claim 3 follow implicitly from a meaningful notion of *relevance value* within the context of the method above, it cannot be said that these aspects would be readily apparent from the teachings of Davidson et al. or Azarbayejani et al. or any encountered prior art methods. In this manner, the subject matter of claim 3 is unique and non-obvious with respect to the encountered prior art methods.

Conclusion

Applicant's amendment necessitated the new grounds of rejection presented in the Office Action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wes Tucker whose telephone number is 571-272-7427. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 571-272-7414. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wes Tucker

5-4-05

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